IN THE DRAWINGS

Replace Figures 1, 1a, 1b, 2, 3A, 3B, 3C, and 8a with new Figures 1, 1a, 1b, 2, 3A, 3B, 3C, and 8a enclosed herewith.

REMARKS

The Applicant has amended Figures 1, 1a, 1b, 2, 3A, 3B, 3C, and 8a as follows:

FIG.1:

- Added reference number "100", which is mentioned in par. [37] of the original specification as filed, but was missing in the original FIG.1;
- Reference numbers "102" and "104" now refer to correct portions of the structure shown in FIG.1, to correspond to the FIG.1 description in paragraph [37] of the original specification as filed, and to the positions of labels "Directional coupler tap" and "Signal out" in the original FIG.1.

FIG. 1a, 1b:

- Labels "Prior Art" are added to the drawings, as requested by the examiner, to comply with 37 CFR 1.121(d).

FIG.2:

- Added reference number "28", which is mentioned in par. [11] of the original specification as filed, but was missing in the original FIG.2, as requested by the Examiner;

FIG.3a:

- Label "Section A: Conventional coupler" amended to read "Conventional directional coupler";
- Orientation of the Y-axis label "Transmission" changed to vertical.

FIG.3b:

- Label "Section B: Compensating bend" amended to read "Compensating bend";
- Y-axis label "Insertion loss" amended to read "Transmission" to correspond to Y-axis labels in FIGs. 3A and 3C, and its orientation changed to vertical;
- TE and TM curves inverted to correspond to TE and TM transmission coefficients rather than to the Insertion Loss, according to a well-know in the art relation "Transmission = 1 - Insertion Loss", in linear units.

FIG.3c:

- Orientation of the Y-axis label "Transmission" changed to vertical.

FIG.8a:

- A label "Tap outputs" is added to the figure for clarity.

The Applicant has amended the disclosure by correcting grammatical and typographical errors in the following paragraphs: [1], [2], [8], [10], [11], [12], [13], [36], [37], [39], [40], [43], including:

- Paragraph [1], end of second line is amended by changing "and" to "an", in the following wording ".. to ~~and~~ an output tap end", to correct for a typographical error;
- Paragraph [39], second sentence on lines 3,4 is amended as follows: "This is illustrated in Figure [[3c]] 3a ~~at the bottom left~~ showing input-to-tap transmission.", to correctly refer to Figure 3a, and to add clarity to the description of the figure;

- Paragraph [44], second line is amended, as requested by the Examiner, by adding an opening parenthesis before the wording "0.7% to 8%" and a space after, in the following wording "Low delta (0.7% to 8%) waveguides", to correct for a typographical error.

Claims 1-4 are pending in this application.

Claims 1-4 have been rejected under 35 U.S.C. 103(a) as being unpatentable over applicants admitted prior art in view of Rajarajan et al, "Novel Polarization-Independent Optical Bends for Compact Photonic integrated Circuits", SBMO/IEEE MTT-S IMOC 1999.

The Applicant respectfully traverses the Examiner's assessment that, in view of Rajarajan et al, "*..it would have been obvious to one having ordinary skill in the art at the time the invention was made to use a predetermined bend in applicant's admitted prior art to make the device polarization-independent for optimum coupling efficiency*".

As the Examiner points out, Rajarajan et al. teach a **polarization-independent bend**, and how to realize said polarization-independent bend; see e.g. Abstract, and the text pointed out by the Examiner, i.e., lines 16-18 on page 453, left column, of the cited paper by Rajarajan et al.

Contrary to the polarization-independent bend of Rajarajan et al, claims 1 to 4 of the present invention define

waveguides bends which are substantially polarization-dependent.

Indeed, in the broadest aspect, claims 1-4 of the present inventions define waveguide structures comprising a waveguide ("*second waveguide*" in claims 1,2, or "*branch waveguide*" in claims 3,4) having a polarization-dependent "*coupling portion*" for receiving light from another waveguide ("*first waveguide*" in claims 1,2, or "*trunk waveguide*" in claims 3,4) and a "*portion … distinct from the coupling portion having at least one predetermined bend therein*" (claim 1), wherein the predetermined bend is such that it introduces a polarization dependence opposite to the polarization dependence of the coupling portion for compensating, or "nulling", thereof.

For example, claim 1 defines the claimed invention as (emphasis in bold added) "*a planar optical waveguide tap substantially absent of polarization dependent loss from an input end to an output end*", which comprises:

(a) "*a first optical waveguide for supporting a first polarization mode and a second polarization mode…*";

(b) "*a second optical waveguide having at least (c) a coupling portion … for receiving a portion of light launched into the first optical waveguide into the second optical waveguide, said coupling portion,* ***inherently coupling light in a substantially polarization dependent manner,*** *such that a first polarization mode couples significantly more strongly than a second polarization mode into the second optical waveguide from the first optical waveguide*"; and,

(d) "*a portion of the second optical waveguide…* ***having at least one predetermined bend*** *therein which allows light of the first polarization mode to radiate out of the bend portion of*

the waveguide... with greater efficiency than light of the second polarization mode ***thereby effectively nulling a polarization dependence that occurs from the coupling portion..***".

Claim 1 therefore defines "*a planar optical waveguide tap substantially absent of polarization dependent loss from an input end to an output end*" wherein an inherent polarization dependence of a coupling region is compensated, or "*nulled*", by adding a waveguide bend having a polarization dependence opposite to the polarization dependence of the coupling portion.

Replacing the **polarization-dependent** bend (d) of the present invention with the **polarization-independent** bend of Rajarajan et al. would not lead to the claimed invention, since the polarization-independent bend of Rajarajan et al. would not be "*effectively nulling a polarization dependence that occurs from the coupling portion*", as it is stated e.g. in claim 1. The same reasoning applies to claims 2-4 of the present invention.

It may be noted that Rajarajan et al. teach that there are design parameters that lead to polarization-dependent waveguide bends, wherein two polarization modes, i.e., TE and TM, have different losses; see e.g., FIG.2 of Rajarajan et al. However, the results of Rajarajan et al. are not directly applicable to optical coupling between two waveguides. Therefore, from the teachings of Rajarajan et al., it would not be considered obvious to one of ordinary skill in the art that polarization-dependent bends could be used for "*effectively nulling a polarization dependence that occurs*

from the coupling portion" in an optical coupling between two waveguides, since adding an arbitrary polarization-dependent element to a first polarization-dependent optical element, e.g. to the "*coupling portion*", would not necessarily result in the "*effectively nulling a polarization dependence that occurs from*" the first optical element.

Furthermore, it may be noted that it has been known for decades that optical transmission of waveguide bends can be polarization-dependent; this was shown, for example, by Marcaliti in a paper entitled "Bends in optical dielectric guides", published in Bell Syst. Tech. J., vol. 48, pp. 2103-2132, Sept. 1969 (see e.g. formulas 27, 28 therein). A copy of which is enclosed with an associated Information Disclosure Statement.

However, to the best of the Applicants' knowledge, no one has heretofore disclosed "*nulling a polarization dependence that occurs from the coupling portion*" of a waveguide by using a "*predetermined bend*" in a portion of the waveguide "*distinct from the coupling portion*", for obtaining "*a planar optical waveguide tap substantially absent of polarization dependent loss from an input end to an output end*", despite the practical importance of developing polarization-independent waveguide taps for applications, including power monitoring in reconfigurable optical add/drop multiplexers (ROADM).

For example, U.S. Patent 5,539,850, issued to Henry et al. 17 years after the paper of Marcaliti was published, which is acknowledged as a prior art in the original specification of the present application, discloses compensating the polarization dependence of a waveguide tap by adding a second

waveguide tap. This solution results in a tap structure, which is about twice as large as a single waveguide tap, thereby severely limiting it usefulness for many applications, especially where arrays of taps are required, e.g. as illustrated in FIGs. 8a, 8b of the specification of the present invention.

The present invention provides a considerable improvement to this prior art solution by recognizing that a simple pre-determined waveguide bend with a pre-determined radius (claim 3 of the present invention) can be used in place of the second tap, thereby considerably simplifying the waveguide system and making it more compact.

Another U.S. patent 6,807,004, issued to Carver in 2004, 35 years after the Marcaliti paper was published, and a copy of which is enclosed with an associated Information Disclosure Statement, discloses using a polarization dependence of a metal surface at oblique incidence to compensate an optical tap. Note that the polarization dependence of reflectivity of metals has been known in the art since at least 19th century. This solution, however, does not lend itself easily to integrating with silica-on silicon waveguides.

Therefore, the present invention offers a novel and elegant solution to the known problem of the polarization dependence of silica-on-silicon waveguide taps, which is substantially and advantageously different to the prior art solutions, and which has not been identified in the art, despite multiple prior attempts to solve the problem addressed by the present invention.

The Office Action further identifies the following prior art made of record and not relied upon, but considered pertinent to the present invention:

a) Song et al., Scalar BPM Analyses of TE and TM polarized fields in bent wavguides, IEEE Transactions on Antennas and Propagation, Vol. 51, No.6, June 2003, and

b) U.S. Patent 5,838,844 to Van Dam et al.

c) U.S. Patent 4,983,006 to Nishimoto.

The prior art documents (a) and (b) teach an optical waveguide coupler wherein a curved waveguide section operates as a polarization converter. By arranging such a converter, operating as a $\lambda/2$ plate, at a symmetric location in the waveguide, such that the polarization dependencies of the waveguide on both sides of the converter are equal, it can be used in circuits where the guiding of radiation through a waveguide is polarization dependent; see e.g. ref. (b), col. 2, line 64 - col.3, line 3.

Replacing the bend waveguide portion of the present invention with such a polarization converting bend would not lead to the claimed invention, but rather would most likely increase the polarization dependence of the overall tap structure of the present invention.

Applicant would like to note also that, for silica-on-silicon waveguide bends of the type disclosed in the present

invention, the polarization conversion effect disclosed in ref. (a) and (b) would be negligible. Opposite to the polarization converting bends of this prior art, the bend waveguide portion of the claimed invention functions to induce differing radiation losses for two polarization states, rather than to convert one of the polarization states into another.

Finally, ref. (c) discloses an optical waveguide switch, wherein two optical waveguides disposed close to each other are formed in a crystal substrate displaying an electro-optic effect, with electrodes provided to affect switching. The structural solution taught in ref. (c) aims at reducing the device length by making the width of the optical waveguides in the light intake/outlet parts consisting of curved optical waveguides greater than the width of the optical waveguides of the optical coupling part, thereby enabling higher bend curvature without increasing optical loss and the PDL. Reference (c) does not anticipate the claimed invention, as it does not provide a silica-on-silicon waveguide tap wherein the inherent polarization dependence of a coupling portion is compensated by a polarization dependence of a bend waveguide portion.

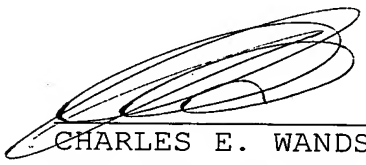
In view of the foregoing corrections and arguments, it is respectfully submitted that the instant application is now in condition for allowance.

Early and favorable reconsideration of the Examiner's objections would be appreciated.

Should any minor informalities need to be addressed, the Examiner is encouraged to contact the undersigned attorney at the telephone number listed below.

Please charge any shortage in fees due in connection with the filing of this paper, including Extension of Time fees, to Deposit Account No. 50-1465 and please credit any excess fees to such deposit account.

Respectfully submitted,



CHARLES E. WANDS
Reg. No. 25,649

CUSTOMER NO. 27975

Telephone: (321) 725-4760

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: MAIL STOP AMENDMENT, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450, on this 5 day of July, 2005.